

## EXPOSURE ASSESMENT: PAST AND PRESENT

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**Background and Aims:** Biomonitoring of exposure to short-lived chemicals is inherently complex. Furthermore, the multiple biomarkers that can be used for biomonitoring complicate the interpretation, compromise the specificity of the measurement and hinder our ability to link exposure to disease.

**Methods:** We have explored multiple markers of exposure to organophosphorus (OP) insecticides, their longitudinal variability, matrix stability and measurement error. Our evaluations have employed state-of-the-art mass spectrometry-based methods to understand the distribution of OP pesticide biomarkers in multiple matrices, their long term stability in various matrices, the contributions from non-toxic preformed environmental degradates, and their overall relation and measurement error.

**Results:** While serum/plasma measurements of the intact pesticide are more selective biomarkers of exposure, blood levels of these chemicals tend to be in the low pg/mL range, typically about 3 orders of magnitude lower than urinary metabolite levels. While urinary metabolite levels are typically significantly correlated ( $r > 0.5$ ,  $p < 0.001$ ), mass balance between exposures and metabolite levels can rarely be achieved. Significant contributions to urinary metabolite levels from preformed metabolites can occur. In fact, in many common food matrices, up to 30% of the pesticide residue can be converted to its preformed metabolite under normal storage conditions. Protein adduct measurements of OP pesticides allow retrospective and time-integrated exposure assessments but the measurements are cumbersome and costly. Although OP pesticides are not believed to appreciably bioaccumulate, certain OP pesticides can be deposited in adipose tissue.

**Conclusions:** While measuring the intact pesticide in biological matrices is the most selective measurement of OP pesticide exposures, this measurement can be hindered by analytical limitations. Creative, holistic approaches to assess OP pesticide exposure must be undertaken in order to fully understand their relation to disease.